

Foreign Bodies in the Air and Food Passages

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INGESTED MATERIAL which becomes lodged in the esophagus will lead to symptoms necessitating its removal. Material aspirated into the respiratory passages will lead to pulmonary symptoms requiring removal. During the 1960's at the Medical College of Virginia Hospitals, 251 patients had foreign material lodged in either the air or food passages (Fig. 1). The vast majority of foreign bodies in air and food passages were seen in the pediatric age group (between birth and 5 years) (Fig. 2). One hundred fifty-one patients (60%) were in the pediatric age group, while 100 (40%) were adults. Two hundred (80%) patients had esophageal foreign bodies and 51 (20%) had airway foreign bodies.

Foreign Bodies of the Esophagus

A total of 116 foreign bodies obstructed the esophagus in the pediatric age group and 94 occurred in adults (Table 1). In the pediatric age group, the overwhelming offending foreign body was a coin; next were meat, bone, buttons and tacks (Table 2). However, in the adult group, 91 per cent of the foreign bodies were either meat or bone. Table 3 documents the remaining types of obstruction seen in the esophagus in both the pediatric and adult age group. Obviously, small objects which can be swallowed should be kept at a safe distance

from children to reduce the numbers of foreign bodies lodged in the esophagus in the pediatric age group. The majority of patients (89%) with foreign bodies in the esophagus had no evidence previously or subsequently of intrinsic esophageal disease (Table 4). During this 10-year span, no patient with malignant disease of the esophagus had a retained foreign body.

Diagnosis

The diagnosis of foreign bodies in the esophagus is relatively easy. The parent of the child who has ingested a foreign body will frequently give a history of such ingestion which causes chest or throat discomfort, possibly some gagging, vomiting or excessive salivation, and dysphagia.

Respiratory distress sometimes is evident because of regurgitation and aspiration of saliva from the esophagus into the trachea. Large esophageal foreign bodies when lodged in the cervical esophagus may lead to predominant airway obstructive signs with wheezing due to partial pressure on the airway. In adult patients there is a frequent history of alcoholic intake, the consumption of meat with improper chewing, occasionally associated with the lack of proper dentures.

Instances in which bone causes an abrasion of the pharynx or esophagus, and then passes on, pain is usually not as severe as when a bone is lodged in the esophagus and is likely to decrease in intensity. However,

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many such abrasions cannot be differentiated from an actual foreign body except by esophagoscopy. All bones lodged in the esophagus are not easily detectable by x-ray. Therefore, the clinical symptoms must be relied upon to determine whether esophagoscopy is indicated. After a bone has been swallowed, patients who develop pain on swallowing during a meal, should undergo esophagoscopy unless the pain rapidly disappears regardless of the x-ray findings.

Patients in whom a large bolus of meat lodges in the esophagus give a somewhat different history. In these patients, sudden esophageal obstruction is noted while eating, and generally a bolus of meat causes the obstruction (usually beef or chicken). Frequently these patients have transient or minimal dysphasia dating back for several years. However, these symptoms were mild and not sufficient to require medical treatment. Small hiatus hernias with proximal muscle spasm from reflux can initiate the lodging of such a foreign body in the esophagus after which the patient is unable to eat or drink without regurgitating. Complete esophageal obstruction from a large bolus of meat can be verified by the patient is inability to drink water without regurgitating. Since no acid is present in the re-

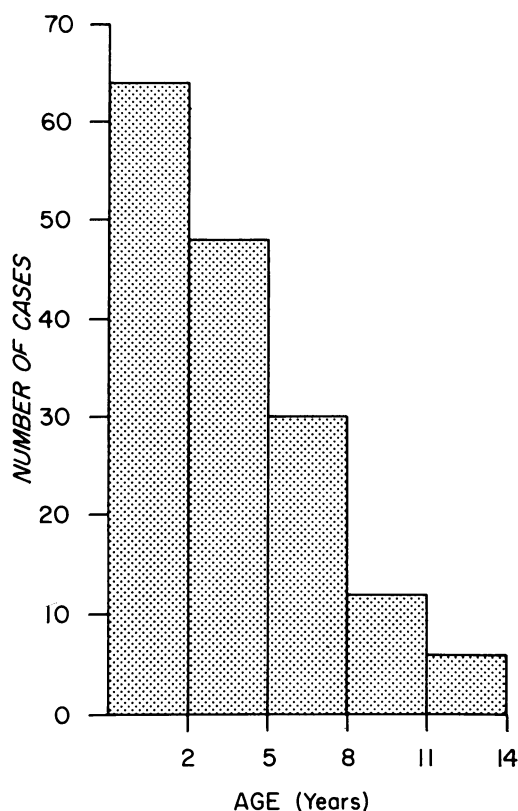


FIG. 2. Foreign bodies of the air and food passages (Pediatric Age Group—MCV-1960-1970).

gurgitated food or water it confirms the fact that it did not enter the stomach. Further documentation of such obstruction can be seen on barium x-ray.

Careful examination of the pharynx using the mirror technic is most helpful in eliminating any possible obstruction in the upper swallowing passages. Any foreign body lodged in these areas can be simply removed. Following local intra-oral examination, it is important to carefully examine the neck and throat externally to check for tenderness, masses, or possible subcutaneous emphysema that may result from penetration of the esophageal wall and leakage of air and saliva into the surrounding esophageal area. Auscultation of the neck and chest is important to check for air in the tissues.

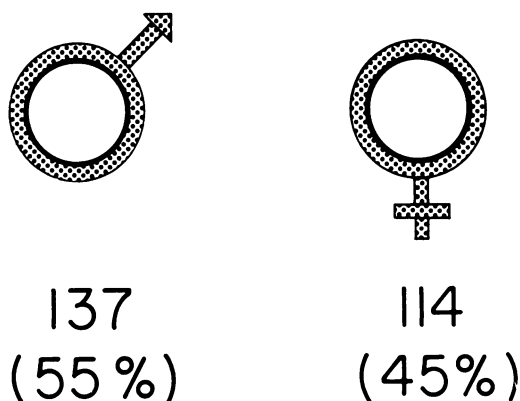


FIG. 1. Foreign bodies in air and food passages (MCV-1960-1970).

TABLE 1. Foreign Bodies in Esophagus
1960-1970

Organ	Pediatric	Adult
Esophagus		
Upper 1/3	82	56
Middle 1/3	18	15
Lower 1/3	16	23
	—	—
	116	94

X-Ray Examination

Routine PA and lateral chest and neck x-rays are extremely important to visualize retained radiopaque foreign material. X-rays taken in the lateral projection removes the calcification of the vertebral body which may obscure light opacification in foreign material. Figure 3 shows a radiopaque bone spicule present in the esophagus at the pharyngo-esophageal junction.

If obstruction of the esophagus has occurred because of foreign body, an air fluid level seen in the esophageal area may indicate such total esophageal obstruction even though the foreign body itself cannot be visualized by direct x-ray.

Should the esophageal wall be penetrated by a foreign body, subcutaneous and/or mediastinal air will be visualized by x-ray. Regurgitation and aspiration of esophageal contents will show pneumonitis suggesting esophageal obstruction.

Figure 4 shows excellent visualization of a radiopaque jack in the esophagus. Figure

TABLE 3. Foreign Bodies in Esophagus (Con't)

Objects found in esophagus of pediatric patients: (25)
Springs, jack rocks, safety pins, screw bolt, ear ring & chain clasps, key chain link, rings, lead slug, toy bell, key, washer, cross, tin foil, rock, plastic piece, gum.
Objects found in esophagus of adult patients: (8)
Safety pin, dental prosthesis, oranges, rubber feeding tube, wooden tongue blade.

5 illustrates two coins, one on top of the other, in the proximal esophagus at the site of aortic indentation in the esophagus.

Figure 6 illustrates a large bolus of steak in the lower esophagus of a previously asymptomatic man. Barium swallow x-ray outlines the typical appearance of this retained meat foreign body.

If a foreign body is not seen by routine examination and x-rays, the ingestion of a small amount of barium with careful study may locate and outline the obstruction. The plastic ring in the esophagus outlined by barium swallow x-ray in Figure 7 is a clear example of this type of identification.

Esophagoscopy is necessary for diagnosis when all other diagnostic methods fail to identify a possible retained foreign body in a patient with persistent symptoms.

Treatment

Foreign bodies in the esophagus can be removed by use of esophagoscopy. Esophagoscopy for removal of foreign material should be carried out under general anes-

TABLE 2. Foreign Bodies in Esophagus
MCV 1960-1970

Object	Pediatric	Adult
Coin	69	1
Meat	6	51
Bone	5	34
Button	6	0
Tack	5	0
	—	—
	91 (78%)	86 (91%)

TABLE 4. Previous Esophageal Disease

1. None	178 (89%)
2. Old stricture	4
3. Hiatus hernia	6
4. Congenital WEB	2
5. Lye stricture	4
6. Lye stricture with small bowel anas.	1
7. Corrected T. E. fistula	3
8. Diverticula	1
9. Diverticula with stricture	1

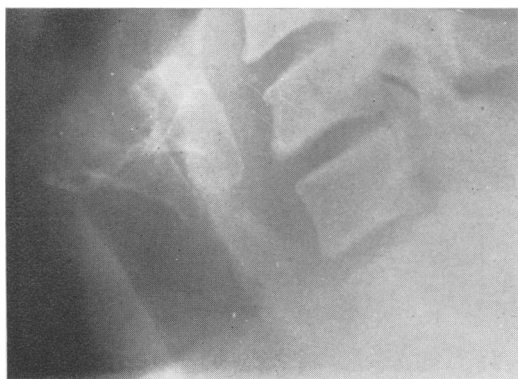


FIG. 3. Small piece of bone lodged obliquely in cervical esophagus. Air in esophagus and trachea is clearly seen in this lateral projection. Symptoms were constant left neck pain, with exacerbation at time of swallowing.

thetia with an endotracheal tube in place so that careful removal in the totally relaxed patient can be facilitated. Unless the patient is extremely uncomfortable, an 8-hour period of nothing by mouth is observed prior to the induction of general anesthesia.

An x-ray obtained immediately before operation is very important to eliminate any possible evacuation of the foreign body into the stomach where extraction is seldom, if ever, necessary. Figure 8 illustrates the

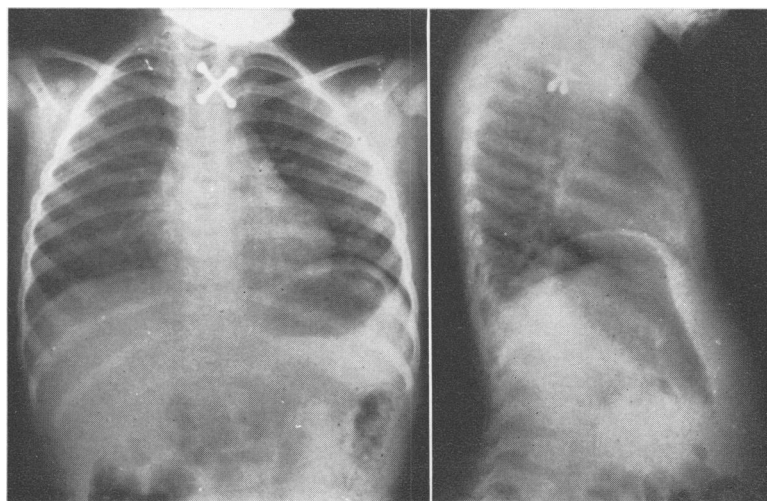
value of such immediate preoperative x-ray studies.

At the time of esophagoscopy, careful attention is paid to the character of the esophageal wall and to the possible presence of blood or a tear in the esophageal mucosa. If the foreign body is too large to be brought through the esophagoscope, simultaneous removal of the esophagoscope and foreign body, firmly grasped with foreign body forceps, must be carried out. Care should be taken at the time of removal that sharp edges do not penetrate or scratch the esophageal wall. If the foreign body cannot be safely brought out through the esophagoscope it should be pushed into the stomach which is a safe and acceptable procedure.

Bigler² and Symbas²⁶ suggested the use of a Foley catheter and local anesthesia for removal of smooth radiopaque foreign bodies in the esophagus (Fig. 9). We have not used this technic because the foreign body may lodge across the epiglottis at the time of withdrawal and cause asphyxiation.

If a reliable patient has reported ingestion of meat with prompt obstruction, and if x-rays show no bone, we have preferred using enzymatic removal rather than esoph-

FIG. 4. Clearly visualized metal "jack" in upper $\frac{1}{3}$ of esophagus. Dysphagia, neck pain, dyspnea, and mild stridor were present.



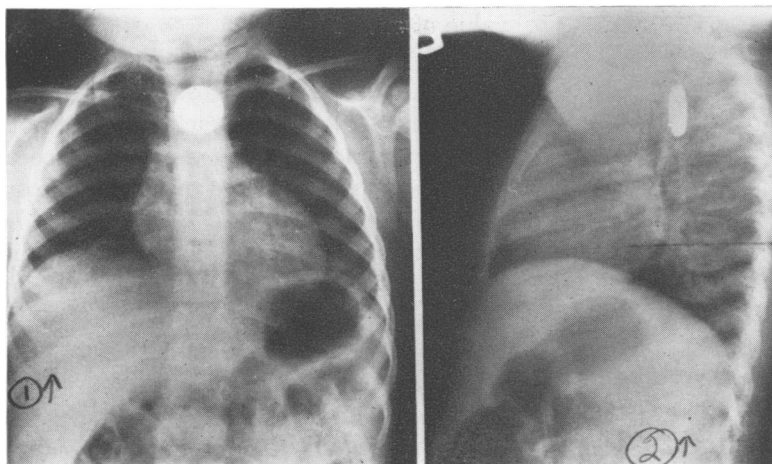


FIG. 5. Two coins in upper $\frac{1}{3}$ of esophagus lying one immediately on top of other.

agoscopy. We use 20% caroid (papaine) in 10% alcohol. Five cc. of this mixture is ingested each 5 minutes for 1 hour. Enzymatic softening of the meat will cause it to pass into the stomach after this management. Richardson²⁰ first described this method in 1945. Holsinger⁹ and Andersen¹ have reported perforation of the esophagus secondary to the use of such a digestant.

We have seen no complications from its use. Prior to giving this material by mouth, Levin tube irrigation and aspiration of the esophagus is carried out so that no material obstructs the passage of the enzyme directly to the meat. During the past 10 years, meat has been removed by the esophagoscope in 26 patients. Three had perforations caused by manipulation with the esophagoscope

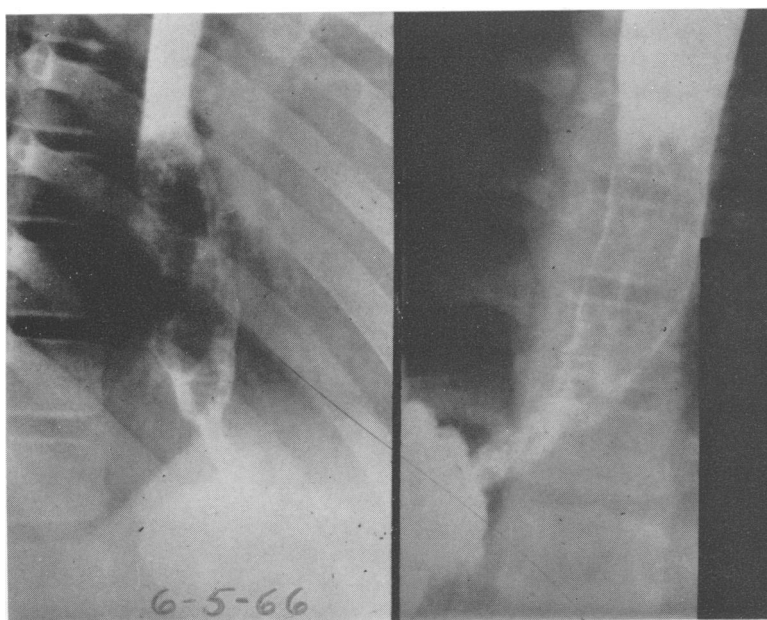
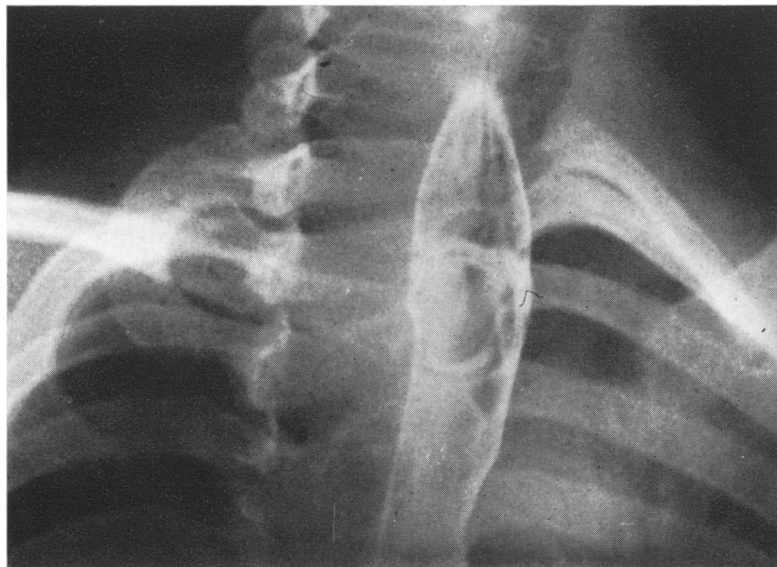


FIG. 6. Large meat bolus in lower $\frac{1}{3}$ of esophagus outlined as filling defect in barium esophagogram. Obstruction is not complete.

FIG. 7. Plastic ring in upper $\frac{1}{3}$ of esophagus visualized as negative shadow at time of doing esophagogram with thin barium.

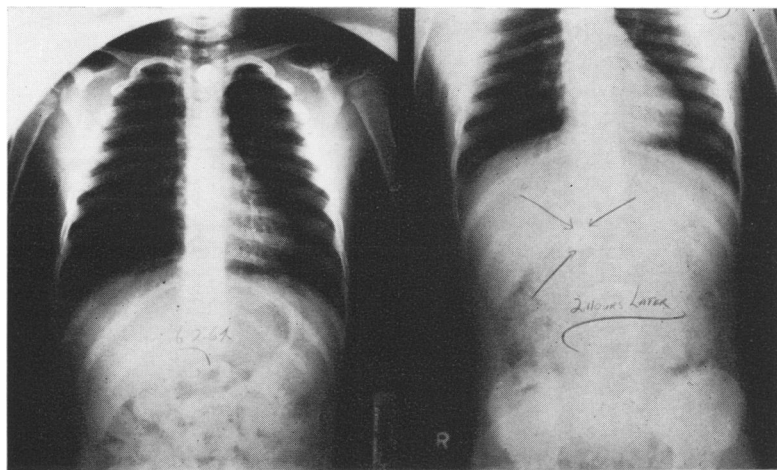


and/or foreign body forceps. One patient died because of fulminating mediastinitis despite prompt drainage and closure of the esophagus. Another death occurred in this group because of a reaction to local anesthetics. However, 25 patient treated with the enzymatic technic using caroid and alcohol all responded without complication.

Three patients in our series (1.5%) had sharp foreign bodies lodged in the esophagus which caused perforation and abscess

formation. Prompt recognition of esophageal perforation (Table 5) is important for immediate removal of the foreign body and closure of the esophagus with drainage of either the cervical or mediastinal area around the perforation. Most patients with perforation of the esophagus have had intense pain, systemic toxicity characterized by elevated temperature, rapid pulse, rapid respiration and a sense of impending danger.

FIG. 8. (A left) Coin in upper $\frac{1}{3}$ of esophagus. (B right) Two hours later and just prior to induction of anesthesia, repeat x-ray shows coin in stomach. Passage through G.I. tract from this point is virtually routine.



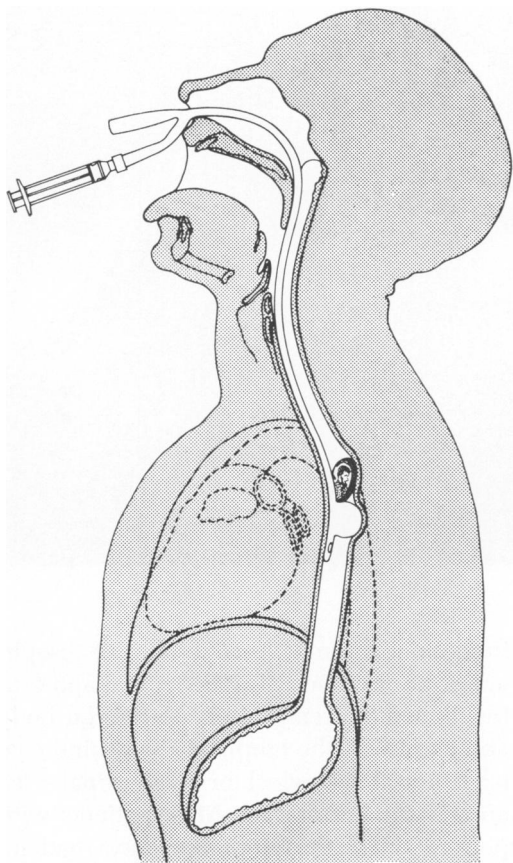


FIG. 9. Foley catheter through nose, into esophagus with catheter balloon inflated coin can be removed as catheter is withdrawn.

After removal of a foreign body from the esophagus, diagnostic esophagogram should be carried out approximately 2 weeks later. Studies done earlier than 2 weeks may be confusing because of esophageal edema and require further study. If dilatation of the

TABLE 5. *Recognition Esophageal Perforation*

1. Pain (Substernal, neck, epigastric, back)
2. Systemic toxicity
3. Neck mass
4. Subcutaneous emphysema
5. Contrast studies
Treatment
Drainage and/or closure

esophagus is necessary, it is preferable to wait approximately 2 to 3 weeks in order that all reaction secondary to foreign body retention and removal has subsided so that perforation at the time of dilatation will be minimized.

Foreign Bodies in the Air Passages

Foreign bodies in the air passages occurred in 51 patients in a 10-year period of study. No patient in this group had more than one foreign body over the 10-year span. Table 6 illustrates the area of tracheo-bronchial tree in which the foreign body was lodged in both the adult and pediatric age group. The predominant age group which had obstruction in the air passages was the pediatric age group. In this group, 45 of 51 foreign bodies were seen in the air passages over our 10-year period of study. The left main bronchus was most frequently involved. Tables 7 and 8 show the types of foreign material found in the tracheobronchial tree in our series. The greatest single offender was the peanut with plastic bullets, next in order found in children. In adult patients, alcoholic intake followed by vomiting and aspiration of foreign material ranked high as a causative factor.

Diagnosis

Symptoms of foreign bodies in the air passages are usually vividly recalled. Food

TABLE 6. *Foreign Bodies in Air Passages 1960-1970*

Organ	Pediatric	Adult
Trachea	9	—
R. M. B.	9	1
R. U. L.	—	1
R. I. B.	6	2
R. L. L.	4	1
L. M. B.	11	—
L. U. L.	2	—
L. L. L.	4	1
	45	6

TABLE 7. *Foreign Bodies in Air Passages*
MCV 1960-1970

Object	Pediatric	Adult
Peanut	19	1
Plastic bullet	6	0
Safety pin	1	1
Screw	2	0
Sewing needle	1	0
	29 (64%)	2 (33%)

No Repeaters

TABLE 8. *Foreign Bodies in Air Passages (Con't)*

Objects found in air passages of pediatric patients: (16) Picture hook, bone, pinto bean, ball pen top, chestnut, crayon, tacks, soy bean, corn kernel, egg shell, tooth, marble, hat pin, bean, rubber balloon.
Objects found in air passages of adult patients: (4) Bones, toothpick, hypo needle.

or an object in the mouth during a sudden episode of coughing, gagging, cyanosis, wheezing, and may occasionally cause near respiratory arrest. Vomiting is not unusual. After the initial violent episode, there is a persistent annoying cough which may or may not be accompanied by audible wheeze which is perceptible at a distance. After prolonged obstruction the cough may be-

come minimal or non-existent. The wheeze usually remains. After aspiration there is frequently minimal or no respiratory distress. The patients frequently breathe quietly and easily not to stir up cough which has been so troublesome immediately following aspiration. An audible wheeze may be present at the bedside and frequently a wheeze is heard by auscultation. The most common physical finding after aspiration is decreased breath sounds over that portion of the lung in which the bronchus is obstructed by the foreign body.

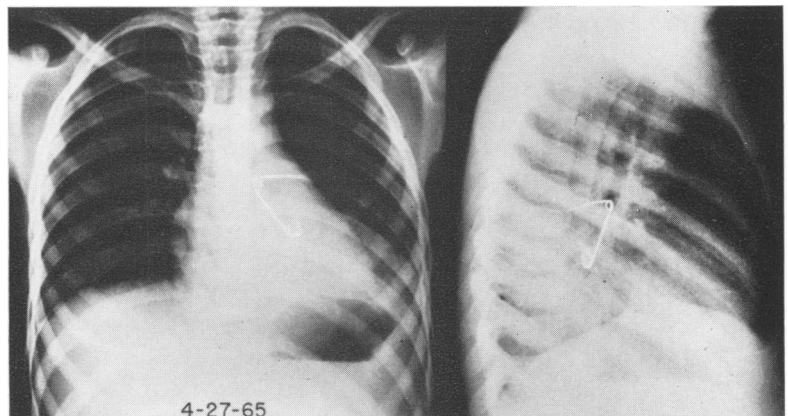
Examination by x-ray is most important. If the foreign body is radiopaque it can be rapidly seen by x-ray. PA and lateral films are important in each study.

Figure 10A illustrates an open safety-pin in the left main bronchus of a young male patient; Figure 10B shows the rust covered pin after extraction by bronchoscopy.

A lateral thoracic view of a child with a history suggestive of peanut in the air passages shows the peanut in the mid-trachea (Fig. 11). The air column of the trachea completely surrounding the peanut helps to outline this usually non-opaque material.

The most reliable x-ray finding in a patient with a recently aspirated non-opaque foreign body of the bronchus is obstructive emphysema ("air trapping") secondary to a

FIG. 10 (A). Open safety pin left main bronchus at superior segment take-off left lower lobe bronchus.



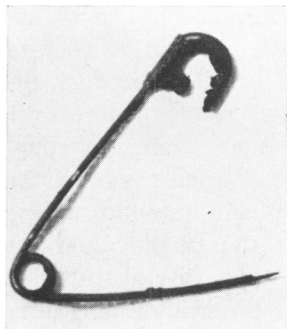


FIG. 10 (B).
Rusty safety pin re-
moved from pa-
tient.

peanut in the left lower lobe bronchus. Obstructive emphysema can be seen on the PA film located in the left lower area of the hemithorax. On the lateral view an enlarged lower lobe from obstructive emphysema is dramatically illustrated. Figure 13 shows the effects of a more firmly entrenched atelectasis. There was some pneumonitis in the right lower lobe of another child with a peanut in the right lower lobe bronchus distal to the middle lobe take off for a period of 3 days.

In a few cases of bronchial foreign bodies there may be a silent period after aspiration, with pneumonia distal to the obstruction occurring several days or weeks later. Therefore in every child who has evidence of pulmonary symptoms; unilateral wheeze; hemoptysis; recurrent pneumonia in the same area of the lung; isolated lung abscesses; or a combination of these, a careful history should be taken dating back over several weeks prior to symptoms of pneu-

monia to determine whether there is any indication of an aspirated foreign body. This is especially true if there is clinical evidence of bronchial obstruction as manifested primarily by suppression of breath sounds or by x-ray evidence of atelectasis.

Treatment

Retained foreign bodies within the lumen and bronchi immediately set up a reaction in the bronchial mucosa causing edema and varying degrees of bronchial spasm. Drainage from the distal aspects of the bronchial systems supplied by the obstructive foreign body is impaired. Atelectasis and infection both bronchial and pneumonic are enhanced. With the passage of time, and varying in degree, dependent on severity of infection, bronchiectasis, bronchial stenosis, lung abscess, empyema and occasionally bronchopleural fistula may develop. These changes may be responsible for loss of functional lung tissue by subsequent surgical resection. Severe hemoptysis caused by erosion from infection or foreign body itself has occurred. Foreign bodies in the tracheobronchial tree may migrate to other areas of the thorax.

With confirmation of a foreign body in the tracheobronchial tree, treatment of choice is extraction by bronchoscopy under general anesthesia. If the patient is not in acute distress, bronchoscopy should be delayed until at least 8 hours following the last meal. If distress is present, bronchos-

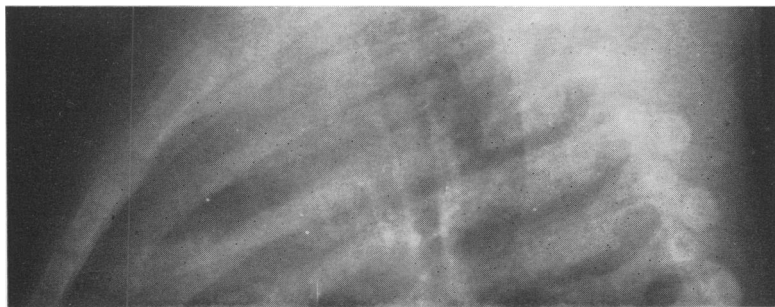
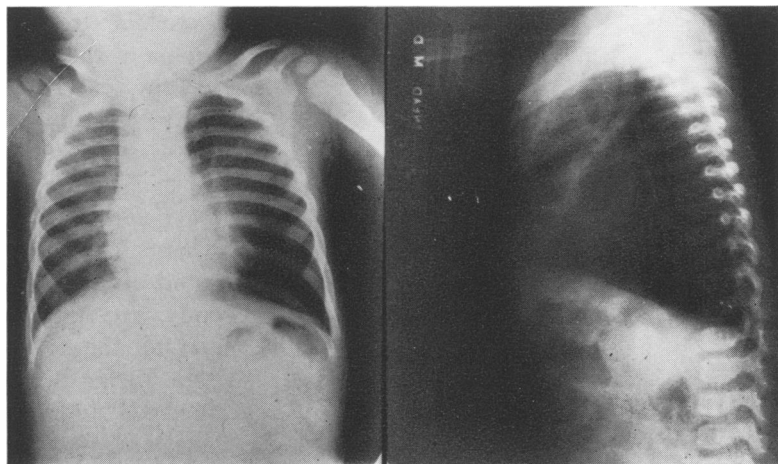


FIG. 11. One half peanut in thoracic trachea proximal to carina. Patient had marked respiratory distress with audible, harsh stridor.

FIG. 12. Peanut in left lower lobe bronchus with obstructive emphysema ("air trapping") clearly shown.



copy should be initiated promptly. We would prefer general anesthesia with relaxing drugs and the use of ventilating bronchoscope.

Without the ventilating bronchoscope, we would prefer a general anesthetic such as ether which allows the patient to be well anesthetized and still continue an adequate respiratory effort. This lessens the haste with which the surgeon must work and allows more prolonged exploration of the tracheobronchial tree for extraction of multiple pieces of foreign material. With the use of the ventilating bronchoscope, one may more easily proceed with relaxing drugs. However, in some cases, this air jet into the tracheobronchial tree may force small particles of foreign material deeper into the bronchus and make it more difficult to manage.

If one cannot definitely establish the presence of a foreign body in the tracheobronchial tree by evidence of a radiopaque foreign body, obstructive emphysema, or pneumonitis, it is safer to proceed with bronchoscopic inspection than to detain the patient for prolonged periods of examination. Most foreign bodies can be extracted with foreign body forceps and minimal trauma.

An additional tool in the removal of foreign bodies from air passages is the Fogarty catheter which was designed for emboli and clot removal from blood vessels. After visualization of the foreign body by bronchoscopy, the Fogarty catheter may be introduced through the bronchoscope and beyond the foreign body. The balloon is inflated and Fogarty catheter withdrawn carrying the foreign body with it (Fig. 14). This was first suggested by Ulliot and Norman.²⁸

Complications after successful endoscopic removal of foreign bodies from the tracheo-

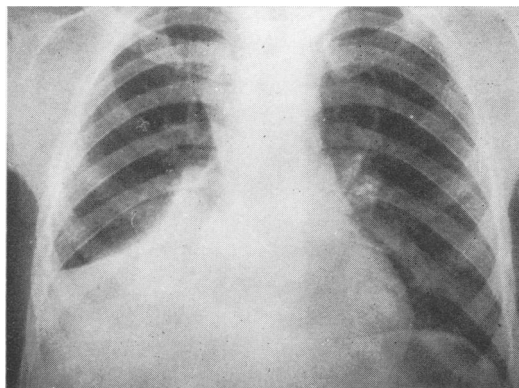


FIG. 13. Complete atelectasis right lower lobe in child with peanut obstructing bronchus for three days.

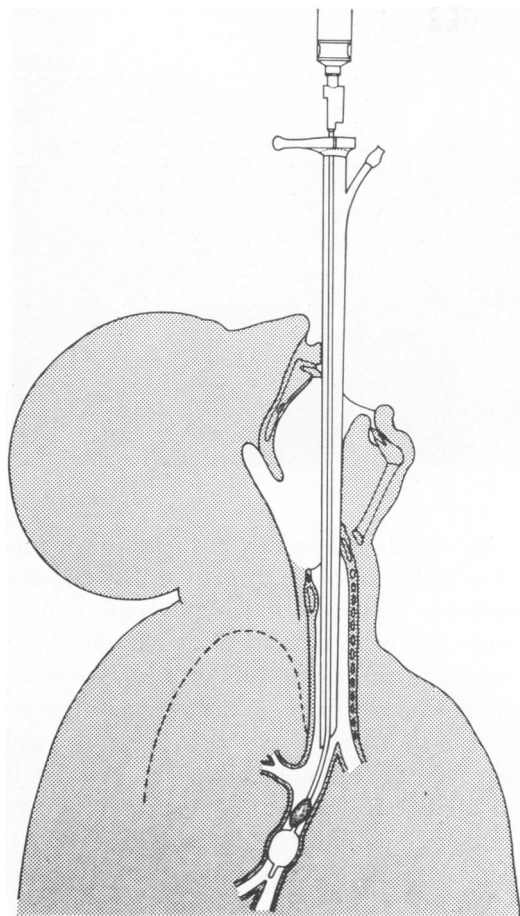


FIG. 14. Fogarty catheter passed through bronchoscope distal to bronchial foreign body, balloon inflated and withdrawn with foreign body.

bronchial tree are usually confined to edema of the vocal cords for which steroid therapy for 12 hours is usually sufficient to control. Occasionally tracheostomy may be life saving in difficult instances as in cases of tracheal occlusion from within or in the epiglottic level. Pneumothorax and/or pneumomediastinum may occasionally be noted after endoscopic removal of foreign body. Prompt tube drainage is then necessary for the pneumothorax.

In Figure 15 a screw is seen in the right intermediate bronchus of a child. Three attempts at removal prior to transfer to our hospital were unsuccessful. Two attempts at our hospital were unsuccessful. The child required thoracotomy for removal of the screw.

In Figure 16 is a child with a sewing needle in the lateral basilar segment of the right lower lobe of the lung. After three unsuccessful bronchoscopies during which we could never see the foreign body nor palpate it with our foreign body forceps, a small thoracotomy was necessary for removal.

Bronchoscopic removal of foreign bodies was successful in all but four cases. Thoracotomy was required in these four cases (8%).

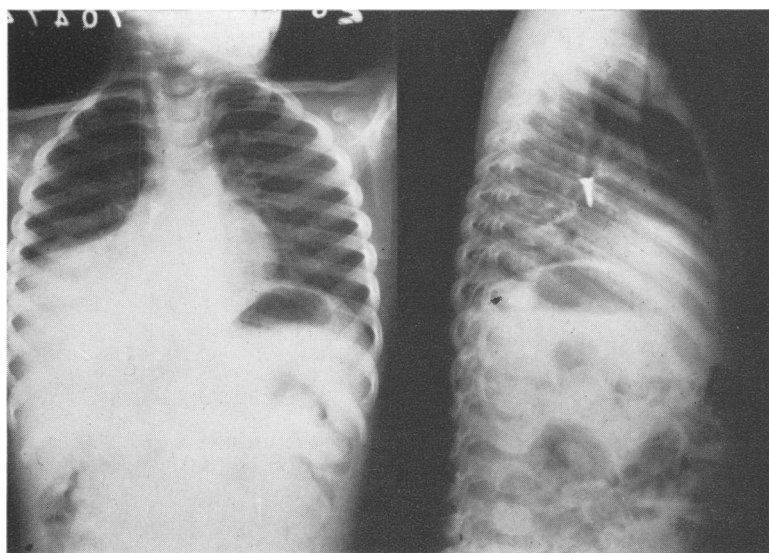
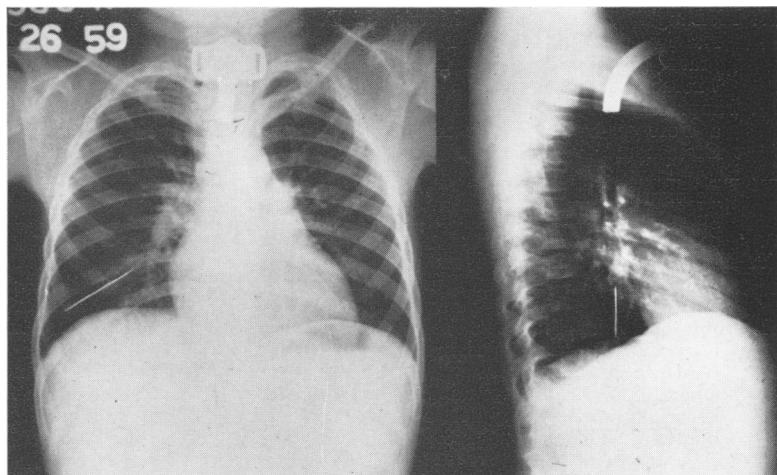


FIG. 15. Screw in intermediate bronchus, right, requiring thoracotomy for removal.

FIG. 16. Sewing needle in periphery right lower lobe of lung removed by thoracotomy.



One patient (2%) developed empyema secondary to pneumonia distal to the foreign body obstruction. After drainage of the empyema there was complete recovery.

There was one fatality (2%) in patients with obstruction of air passages. This occurred in a small child who was inflating a toy balloon which popped while he was blowing it up and it was aspirated into the trachea. He was dead on arrival at the emergency room. The rubber balloon was found at post-mortem examination.

Two of our patients (4%) had cardiac arrest because of tracheal foreign bodies which were successfully extracted in the emergency room with resuscitation efforts.

Summary

Foreign bodies in the air and food passages continue to be potential hazards. Early recognition is usually facilitated by careful history, auscultation of the lungs (in instances of air passage obstruction by foreign bodies), and meticulous x-ray examination. Endoscopy is the treatment of choice. Surgical removal is rarely required.

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DISCUSSION

DR. WATTS R. WEBB (Syracuse): I have very little to add, but I think this paper is too excellent to let it go by without a word of commendation to the author.

I have only one additional suggestion to make, and this is something which I am sure Dr. Brooks did not have time to add. It is of great value in these patients to place them with the feet up and the head down so that gravity will aid removal of

the foreign body. It is very distressing to see a tack or coin or peanut fall deeper into the bronchial tree and then find that you have to do a thoracotomy and bronchotomy to remove the object that would have been very easily removed had the patient been in the head-down position.

DR. J. W. BROOKS (Closing): In closing, I would just like to express my thanks to the Association for being on the program my first year as a member.